

PATENT ABSTRACTS OF JAPAN

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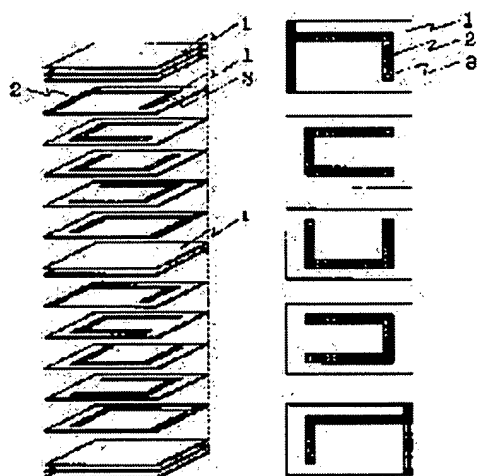
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(22)Date of filing : 25.12.1992 (72)Inventor : KURIHARA KOICHIRO
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(54) LAMINATED INDUCTOR

(57)Abstract:

PURPOSE: To realize a laminated inductor having a large current resistance value corresponding to a high current circuit by extending both ends of a plurality of conductor patterns to two side faces substantially perpendicular to a laminating direction, and so forming an external electrode terminal as to connect the plurality of the patterns in parallel on the two side faces.

CONSTITUTION: A conductor pattern 2 and a through hole 3 are formed on a green sheet 1, cut in a predetermined size, one coils are respectively formed sequentially on conductive patterns A, B, C, E, E in a laminated mold, and two of such a stage are stacked. In this case, two green sheets in which the pattern and the through hole are not formed are laminated between the two coils, and three such green sheets are simultaneously laminated vertically. Then, the laminated green sheet 1 is thermally press injected to manufacture a laminate, and cut into a chip shape. This is burned in the atmosphere, further coated with external electrode containing silver as a main component, and baked. In this case, two coils are electrically connected in parallel.



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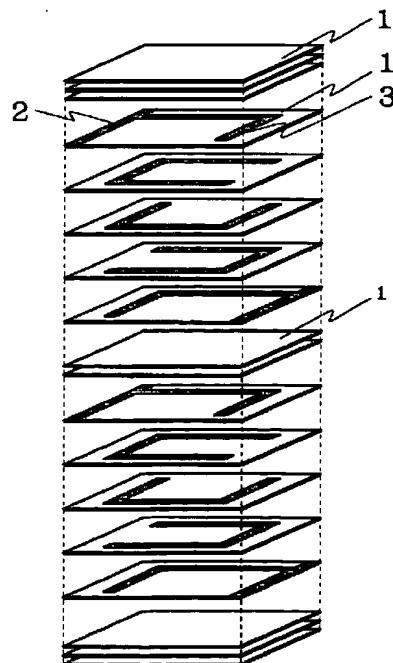
(74)代理人 弁理士 大場 充

(54)【発明の名称】 積層インダクタ

(57)【要約】

【目的】 耐電流値が大きい積層インダクタを提案する。

【構成】 磁性体印刷層または磁性体グリーンシートと印刷導体パターンを積層し、一体焼成した積層インダクタであって、積層方向に重畳するコイル状の複数の導体パターンを有し、前記複数の導体パターンのそれぞれの両端部が、積層方向にほぼ垂直な 2 側面に延長し、前記 2 側面に、前記複数の導体パターンを並列に接続するように、外部電極端子が形成されている積層インダクタ。



【特許請求の範囲】

【請求項1】 磁性体印刷層または磁性体グリーンシートと印刷導体パターンを積層し、一体焼成した積層インダクタであって、積層方向に重畳するコイル状の複数個の導体パターンを有し、前記複数個の導体パターンのそれぞれの両端部が、積層方向に実質的垂直な2側面に延長し、前記2側面に、前記複数個の導体パターンを電気的に並列に接続するように、外部電極端子が形成されていることを特徴とする積層インダクタ。

【請求項2】 請求項1において、磁性体がNi-ZnフェライトまたはNi-Zn-Cuフェライトであることを特徴とする積層インダクタ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、積層型インダクタに関するものであり、特に内部電極の構造に関するものである。

【0002】

【従来の技術】従来のインダクタは絶縁被覆を有する導電線を磁芯の回りに巻装してコイルを形成したものである。しかし、この方法では小型化に限界があり、また、巻線作業により量産性にも問題があった。上記の解決策として、特開昭48-81057号公報、米国特許第3765082号に示されるように、ドクターブレード法によってグリーンシートを形成し、スルーホールを打ち抜き、U字状の導電パターンを印刷し、スルーホールを介して、隣接するシートの導電パターンの端部同士が電気的に接続し、かつ積層方向にコイルが重畳するように積層し、熱圧着することにより一体化し、焼成することにより製造するインダクタが提案されている。(以下、シート法と記述する。) また、特公昭57-39521号公報には、複数個の約半ターン分の印刷導体パターン間に印刷フェライト磁性体層を介在し、かつ縁端部を介して接続して導電パターンが積層方向に重畳するコイルを形成することにより一体化し、焼成するインダクタが提案されている。(以下、印刷法と記述する。)

【0003】

【発明が解決しようとする課題】積層インダクタの形状は、表面実装部品として、縦×横×高さは、3.2mm×1.6mm×0.9mm(いわゆる3216タイプ)や2.0mm×1.25mm×0.85mm(同、2012タイプ)であり、導電パターンを形成できる面積は、それぞれ、3.2mm×1.6mm(3216タイプ)や2.0mm×1.25mm(2012タイプ)と非常に小さい。従って、導電パターンの形成は比較的安価で、微細パターンが可能なスクリーン印刷法が採用されている。しかしながら、導電パターンの断面は高々厚さ20μm、幅300μm程度が限界であり、比較的電気伝導度の高い銀を導電材料として選んでも、耐電流値は低い。無理をして、高電流を流せば、内部で発熱し、

場合によっては、導電材料の融点以上の高温になり、断線する恐れがある。この問題点を解決する方法として、導電パターンの印刷を複数回行い、重ね塗りし、導電体の厚さを増やす方法が考えられる。しかし、シート法では、この増加した膜厚分を磁性体層で吸収せねばならず隣接するシート同士の圧着性が不十分になり、シート間で剥離(デラミネーション)が発生し、素子の信頼性が低下する恐れがある。また、印刷法では電極印刷部分とその他の部分との段差が大きくなり、成形体の表面が凹凸状となる。これを平坦化するためには、印刷積層後の平坦化プレス等の手段が必要となり、工数が増加し、コストアップとなる。以上により、通常の工程を適用して耐電流値を増加させることは非常に困難である。本発明は、上記問題点を解決し、通常の工程を適用して、高電流回路に対応し、耐電流値の大きな積層インダクタを提供するものである。

【0004】

【課題を解決するための手段】上記問題点を解決する方法として、本発明では磁性体印刷層または磁性体グリーンシートと印刷導体パターンを積層し、一体焼成した積層インダクタであって、積層方向に重畳するコイル状の複数個の導体パターンを有し、前記複数個の導体パターンのそれぞれの両端部が、積層方向にほぼ垂直な2側面に延長し、前記2側面に、前記複数個の導体パターンを並列に接続するように、外部電極端子が形成されるものである。

【0005】

【作用】本発明によれば、複数個の導体パターンが並列に接続されているため、耐電流値は導電パターンがひとつのものに比べて、ほぼ並列接続される数に比例した耐電流値が得られる。

【0006】

【実施例】(実施例1)以下、実施例に従い本発明を詳細に説明する。Fe₂O₃、NiO、ZnO、CuOを主成分とするNi-Zn-Cuフェライト粉末に、有機バインダーとしてPVB(ポリビニルブチラル)、可塑剤としてBPBG(ブチルフタリルブチルグリコレート)、有機溶剤としてエタノールおよびブタノールを各々添加して混合し、スラリーを作成した。このスラリーをドクターブレード法によりシリコン処理を行ったポリエステル製のキャリアフィルム上に厚さ50μmのシート状に形成した。これをフィルムから剥離し、約50mm角のシートに切断し、図3に示すように位置合わせ用のガイド穴6が設けられているステンレス製の枠5にグリーンシートを貼り付けた。上記グリーンシート1が貼り付けられた枠5を、位置合わせ用のガイドピンが設けられている穴明け金型に、前記枠5のガイド穴6を合わせてセットし、所定の位置にスルーホール3を多数形成した。次に、スルーホール3が形成されたグリーンシート1に、前記と同様にガイドピンとガイド穴による位置

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合わせ方法により、スルーホール3の位置に対して所定の導電パターン2の位置が合うように、銀ペーストにより導電パターンを印刷した。図5の(A)、(B)、(C)、(D)、(E)に作製に用いたグリーンシート1に形成した動電パターン2とスルーホール3の位置を示す。次に、前記印刷されたグリーンシート1を、前記と同様にガイドピン、ガイド穴を用いた位置合わせ方法により、所定の大きさに切断し、積層金型内に、一つのコイルが導電パターン(A)、(B)、(C)、

(D)、(E)の順に形成されているものを2段積み重ねた。この時、2つのコイルの間には導電パターンおよびスルーホールが形成されていないグリーンシート1を2枚、また上下にも、それぞれ3枚同時に積層した。

【0007】次に、これら積み重ねたグリーンシートを、温度120℃、圧力200kg/cm²の条件で熱圧着し、積層体を作製した。積層体を切断機でチップ形状に切り離した。図1にチップ形状の積層体の内部構造を示す。これを、大気中、500℃で脱バインダーを行い、続いて、900℃で1時間焼成した。さらに、銀を主成分とする外部電極を塗布し、600℃で焼き付け

た。この時、2つのコイルは電気的に並列接続される。最後に、この外部電極上に電解バレルめっきにより、Niめっきおよび半田めっきを施し、積層インダクタを得た。(図2)

作製した素子の耐電流値の評価するために、端子電極間の直流電気抵抗を測定した。本実施例では従来のコイルが並列されていないものに比べて、約1/2であった。従って、耐電流値は約2倍である。

【0008】(実施例2) 実施例1と同様の製造工程を

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*されていないものに比べて、約1/3であった。従って、耐電流値は約3倍である。

【0009】(実施例3) 積層体の製造方法として、特公昭57-39521号公報に記載されている印刷法を採用し、実施例1と同様にコイルが2つ並列に電気接続されるように作製した。作製した素子の端子電極間の直流電気抵抗を測定した。本実施例でも、実施例1と同様に、従来のコイルが並列されていないものに比べて、約1/2であった。従って、耐電流値は約2倍である。

【0010】

【発明の効果】以上、説明したように、本発明によれば、信頼性が低下したり、工数が増加することなく、高電流回路に対応した、耐電流値の大きい積層インダクタ素子が得られる。

【図面の簡単な説明】

【図1】本発明におけるチップ切断した積層体の内部構造を示す図である。

【図2】本発明における作製した積層インダクタの斜視図である。

【図3】本発明におけるスルーホール形成後の説明図である。

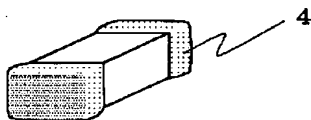
【図4】本発明における導電パターン印刷後の説明図である。

【図5】本発明における積層インダクタの内部電極パターンを示す図である。

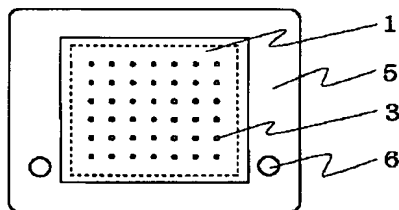
【符号の説明】

- 1 グリーンシート
- 2 導電パターン
- 3 スルーホール
- 4 外部電極
- 5 ステンレス製枠
- 6 位置合わせ用ガイド穴

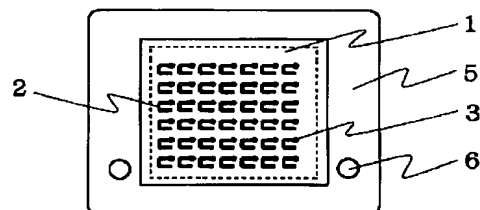
【図2】



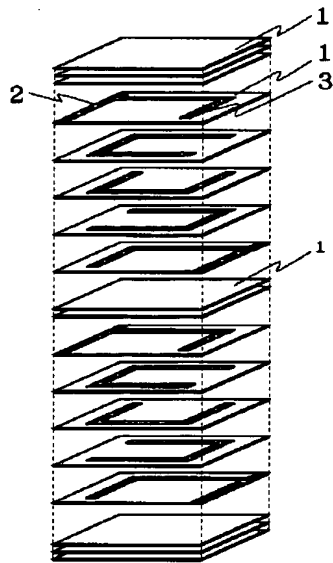
【図3】



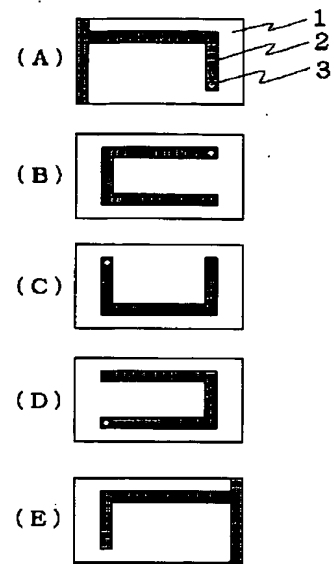
【図4】



【図1】



【図5】



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CLAIMS

[Claim(s)]

[Claim 1] The laminating inductor characterized by forming the external electrode terminal so that may be the laminating inductor which carried out the laminating of a magnetic-substance printing layer or a magnetic-substance green sheet, and the printing conductor pattern, and really calcinated them, it may have two or more coiled form conductor patterns superimposed in the direction of a laminating, it may extend on two side faces where each both ends of two or more of said conductor patterns are substantially perpendicular to the direction of a laminating and said two or more conductor patterns may be electrically connected to juxtaposition on said two side faces.

[Claim 2] The laminating inductor characterized by the magnetic substance being a nickel-Zn ferrite or a nickel-Zn-Cu ferrite in claim 1.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates especially to the structure of an internal electrode about a laminating mold inductor.

[0002]

[Description of the Prior Art] The conventional inductor loops the surroundings of a magnetic core around the electric conduction line which has pre-insulation, and forms a coil. However, by this approach, the limitation was in the miniaturization and there was a problem also in mass-production nature according to a coil activity. A laminating is carried out, by carrying out thermocompression bonding, it unifies and the inductor manufactured by calcinating is proposed so that a green sheet may be formed with a doctor blade method, and may pierce a through hole, as shown in JP,48-81057,A and U.S. Pat. No. 3765082, and a U character-like electric conduction pattern may be printed, and the edges of the electric conduction pattern of an adjoining sheet may connect electrically through a through hole as the above-mentioned solution and a coil may be overlapped in the direction of a laminating. (It is hereafter described as the sheet method.) By forming the coil which intervenes a printing ferrite magnetic layer between the printing conductor patterns for two or more abbreviation half turn, and connects to JP,57-39521,B through the edge again, and an electric conduction pattern superimposes in the direction of a laminating, it unifies and the inductor to calcinate is proposed. (It is hereafter described as print processes.)

[0003]

[Problem(s) to be Solved by the Invention] The area in which vertical x horizontal x height is 3.2mmx1.6mmx0.9mm (3216 so-called types) and 2.0mmx1.25mmx0.85mm (**, 2012 types) as a surface mounted device, and the configuration of a laminating inductor can form an electric conduction pattern is very as small as 3.2mmx1.6mm (3216 types) or 2.0mmx1.25mm (2012 types) respectively. Therefore, formation of an electric conduction pattern is comparatively cheap, and the screen printing in which a detailed pattern is possible is adopted. however, the cross section of an electric conduction pattern -- at most -- the thickness of 20 micrometers and width of face of about 300 micrometers are limitations, and although silver with comparatively high electrical conductivity is chosen as an electrical conducting material, a current value-proof is low. If it is strained and a high current is passed, it generates heat inside, and it becomes an elevated temperature more than the melting point of an electrical conducting material, and there is a possibility of disconnecting depending on the case. On the other hand, as law, it multiple-times-carries out, heavy printing of the printing of an electric conduction pattern is carried out, and the approach of increasing the thickness of a conductor which solves this trouble can be considered. However, by the sheet method, the sticking-by-pressure nature of the sheets which must absorb a part for this thickness that increased by the magnetic layer, and adjoin becomes inadequate, exfoliation (delamination) occurs between sheets, and there is a possibility that the dependability of a component may fall.

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TECHNICAL FIELD

[Industrial Application] This invention relates especially to the structure of an internal electrode about a laminating mold inductor.

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PRIOR ART

[Description of the Prior Art] The conventional inductor loops the surroundings of a magnetic core around the electric conduction line which has pre-insulation, and forms a coil. However, by this approach, the limitation was in the miniaturization and there was a problem also in mass-production nature according to a coil activity. A laminating is carried out, by carrying out thermocompression bonding, it unifies and the inductor manufactured by calcinating is proposed so that a green sheet may be formed with a doctor blade method, and may pierce a through hole, as shown in JP,48-81057,A and U.S. Pat. No. 3765082, and a U character-like electric conduction pattern may be printed, and the edges of the electric conduction pattern of an adjoining sheet may connect electrically through a through hole as the above-mentioned solution and a coil may be overlapped in the direction of a laminating. (It is hereafter described as the sheet method.) By forming the coil which intervenes a printing ferrite magnetic layer between the printing conductor patterns for two or more abbreviation half turn, and connects to JP,57-39521,B through the edge again, and an electric conduction pattern superimposes in the direction of a laminating, it unifies and the inductor to calcinate is proposed. (It is hereafter described as print processes.)

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EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, the laminating inductor component with a large current value-proof corresponding to a high current circuit is obtained, without according to this invention, dependability's falling or a man day increasing, as explained.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The area in which vertical x horizontal x height is 3.2mmx1.6mmx0.9mm (3216 so-called types) and 2.0mmx1.25mmx0.85mm (**, 2012 types) as a surface mounted device, and the configuration of a laminating inductor can form an electric conduction pattern is very as small as 3.2mmx1.6mm (3216 types) or 2.0mmx1.25mm (2012 types) respectively. Therefore, formation of an electric conduction pattern is comparatively cheap, and the screen printing in which a detailed pattern is possible is adopted. however, the cross section of an electric conduction pattern -- at most -- the thickness of 20 micrometers and width of face of about 300 micrometers are limitations, and although silver with comparatively high electrical conductivity is chosen as an electrical conducting material, a current value-proof is low. If it is strained and a high current is passed, it generates heat inside, and it becomes an elevated temperature more than the melting point of an electrical conducting material, and there is a possibility of disconnecting depending on the case. On the other hand, as law, it multiple-times-carries out, heavy printing of the printing of an electric conduction pattern is carried out, and the approach of increasing the thickness of a conductor which solves this trouble can be considered. However, by the sheet method, the sticking-by-pressure nature of the sheets which must absorb a part for this thickness that increased by the magnetic layer, and adjoin becomes inadequate, exfoliation (delamination) occurs between sheets, and there is a possibility that the dependability of a component may fall. Moreover, in print processes, the level difference of an electrode printing part and other parts becomes large, and the front face of a Plastic solid serves as concave convex. In order to carry out flattening of this, the means of the flattening press after a printing laminating etc. is needed, a man day increases, and it becomes a cost rise. It is very difficult to make a current value-proof increase with the application of the usual process by the above. This invention solves the above-mentioned trouble, applies the usual process, corresponds to a high current circuit, and offers a laminating inductor with a big current value-proof.

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MEANS

[Means for Solving the Problem] As an approach of solving the above-mentioned trouble, by this invention, it is the laminating inductor which carried out the laminating of a magnetic-substance printing layer or a magnetic-substance green sheet, and the printing conductor pattern, and really calcinated them, it has two or more coiled form conductor patterns superimposed in the direction of a laminating, and each both ends of two or more of said conductor patterns extend on two side faces almost perpendicular to the direction of a laminating, and an external electrode terminal is formed in said two side faces so that said two or more conductor patterns may be connected to juxtaposition.

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OPERATION

[Function] According to this invention, since two or more conductor patterns are connected to juxtaposition, the current value-proof to which a current value-proof is proportional to the number with which parallel connection of the electric conduction pattern is mostly carried out compared with one thing is acquired.

[Translation done.]

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EXAMPLE

[Example] (Example 1) According to an example, this invention is hereafter explained to a detail. To the nickel-Zn-Cu ferrite powder which uses Fe₂O₃, and NiO, ZnO and CuO as a principal component, BPBG (butyl phthalyl butyl glycolate) was added as PVB (polyvinyl butyral) and a plasticizer, ethanol and a butanol were respectively added as an organic solvent as an organic binder, it mixed to it, and the slurry was created. This slurry was formed with a thickness of 50 micrometers in the shape of a sheet on the carrier film of the product made from polyester which performed siliconizing with the doctor blade method. It exfoliated from the film, this was cut on the sheet of about 50mm angle, and the green sheet was stuck on the frame 5 made from stainless steel with which the guide hole 6 for alignment is formed as shown in drawing 3. The guide hole 6 of said frame 5 was doubled and set to the hole down metal mold with which the frame 5 with which the above-mentioned green sheet 1 was stuck is formed in the guide pin for alignment, and many through holes 3 were formed in the position. Next, the electric conduction pattern was printed with a silver paste so that the location of the predetermined conductor pattern 2 might suit like the above the green sheet 1 with which the through hole 3 was formed to the location of a through hole 3 by the alignment approach by the guide pin and the guide hole. The location of the **** pattern 2 formed in the green sheet 1 used for production at (A) of drawing 5, (B), (C), (D), and (E) and a through hole 3 is shown. Next, said printed green sheet 1 was cut in predetermined magnitude by the alignment approach using a guide pin and a guide hole like the above, and two steps of things by which one coil is formed in laminating metal mold in order of an electric conduction pattern (A), (B), (C), (D), and (E) were accumulated. At this time, the laminating of the green sheet 1 with which the electric conduction pattern and the through hole are not formed between two coils was carried out also to two sheets and the upper and lower sides at three-sheet coincidence, respectively.

[0007] Next, thermocompression bonding of these ***** green sheet was carried out on the temperature of 120 degrees C, and conditions with a pressure of 200kg/cm², and the layered product was produced. The layered product was separated in the chip configuration with the cutting machine. The internal structure of the layered product of a chip configuration is shown in drawing 1. The debinder was performed at 500 degrees C among atmospheric air, then this was calcinated at 900 degrees C for 1 hour.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the internal structure of the layered product in this invention which carried out chip cutting.

[Drawing 2] It is the perspective view of the produced laminating inductor in this invention.

[Drawing 3] It is an explanatory view after the through hole formation in this invention.

[Drawing 4] It is an explanatory view after the electric conduction pattern printing in this invention.

[Drawing 5] It is drawing showing the internal electrode pattern of the laminating inductor in this invention.

[Description of Notations]

- 1 Green Sheet
- 2 Electric Conduction Pattern
- 3 Through Hole
- 4 External Electrode
- 5 Frame made from Stainless Steel
- 6 Guide Hole for Alignment

[Translation done.]

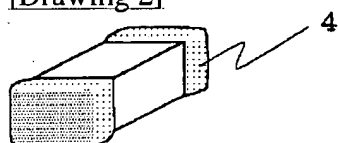
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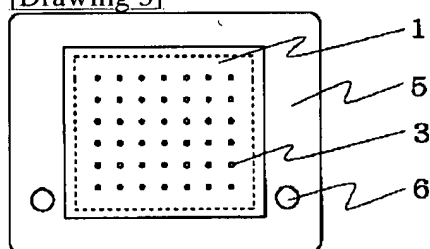
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DRAWINGS

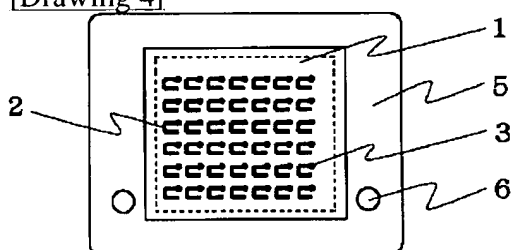
[Drawing 2]



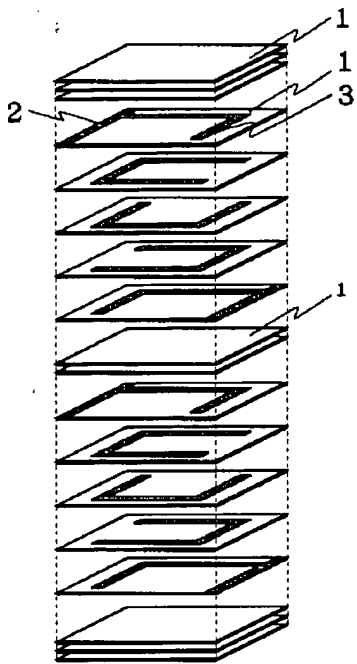
[Drawing 3]



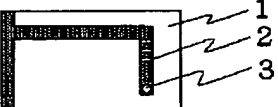




[Drawing 4]



[Drawing 1]



[Drawing 5]

- (A) 
- (B) 
- (C) 
- (D) 
- (E) 

[Translation done.]